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The 21st Century at Work

Forces Shaping the Future Workforce and Workplace in the United States

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Prepared for the U.S. Department of Labor

RAND LABOR AND POPULATION

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SUMMARY

In the next 10 to 15 years, work in the United States will be shaped by demographic trends, technological advances, and economic globalization. Formulation of sound labor policy will require an understanding of how those trends will evolve and affect the size and composition of the labor force, the features of the workplace, and the compensation structures provided by employers. It is our purpose here to contribute to that understanding. In the following pages, we summarize current trends in each of the three principal forces acting on the world of work. In the final section, we draw out some implications that the combination of those forces will have for the future of work. Our key findings are as follows:

- The U.S. workforce will continue to increase in size, but at a considerably slower rate, while the composition will shift toward a more balanced distribution by age, sex, and race/ethnicity. Slower workforce growth may make it more difficult for firms to recruit workers during periods of strong economic growth, although greater participation in the workforce by the elderly, women with children, persons with disabilities, and other groups with relatively low labor force participation could cause the workforce to grow faster. Immigration policy offers another lever for changing the growth and composition of the workforce. Many of the trading partners of the United States are undergoing slower workforce growth and population aging on a more dramatic scale, thus offering a new comparative advantage to the United States.

- The pace of technological change—whether through advances in information technology (IT), biotechnology, or such emerging fields as nanotechnology—will almost certainly accelerate in the next 10 to 15 years. Synergies across technologies and disciplines will generate advances in research and development (R&D), production processes, and the nature of products and services. Further technological advances are expected to continue to increase demand for a highly skilled workforce, to support higher productivity growth, and to change the organization of business and the nature of employment relationships.
- The future reach of economic globalization will be even more expansive than before, affecting industries and segments of the workforce relatively insulated from trade-related competition in the past. The new era of globalization—marked by growing trade in intermediate and final goods and services, expanding capital flows, more rapid transfer of knowledge and technologies, and mobile populations—is partly the result of inexpensive, rapid communications and information transmission enabled by the IT revolution. Globalization will continue its record to date of contributing economic benefits in the aggregate. Although market share and jobs will be lost in some economic sectors with short-term and longer-term consequences for affected workers, the job losses will be counterbalanced by employment gains in other sectors.
- Rapid technological change and increased international competition place the spotlight on the skills and preparation of the workforce, particularly the ability to adapt to changing technologies and shifting product demand. Shifts in the nature of business organizations and the growing importance of knowledge-based work also favor strong nonroutine cognitive skills, such as abstract reasoning, problem-solving, communication, and collaboration. Within this context, education and training become a continuous process throughout the life course involving training and retraining that continues well past initial entry into the labor market. Technology mediated learning offers the potential to support lifelong learning both on the job and through traditional public and private education and training institutions.

- A number of forces are facilitating the move toward more decentralized forms of business organization, including the transition away from vertically integrated firms toward more specialized firms that outsource noncore functions and more decentralized forms of organization within firms. Some sectors may be comprised of "e-lancers," businesses of one or a few workers linked by electronic networks in a global marketplace for products and services. More generally, we can expect a shift away from more permanent, lifetime jobs toward less permanent, even nonstandard employment relationships (e.g., self-employment) and work arrangements (e.g., distance work). These arrangements may be particularly attractive to future workers who seek to balance work and family obligations or such workers as the disabled and older persons who would benefit from alternative arrangements. These changes call attention to the importance of fringe benefits that are portable across jobs, or even independent of jobs (in the case of freelancers, for example).

SHIFTING DEMOGRAPHIC PATTERNS AND THE FUTURE LABOR FORCE

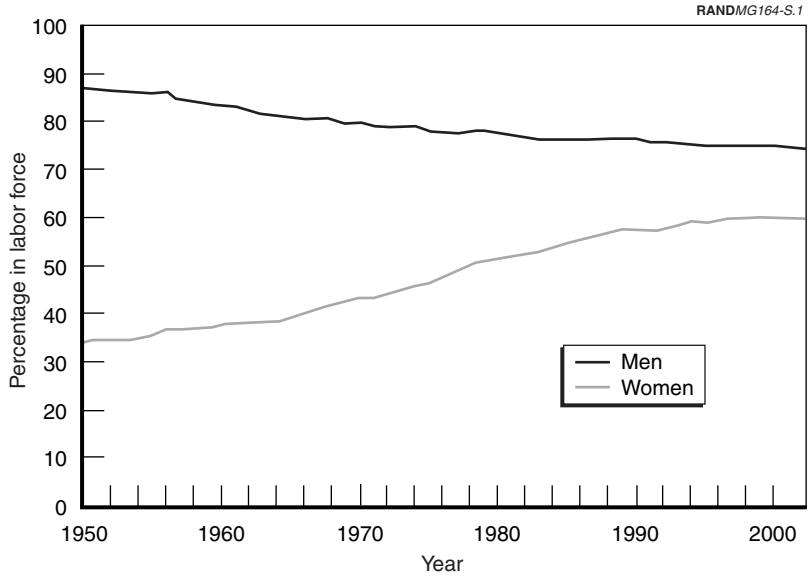
In the next 10 to 15 years, important demographic shifts will continue to influence the size and composition of the workforce. The size and composition of the population, as well as labor force participation rates, determine the number and makeup of people who want to work. Demographic parameters also influence the consumption patterns of the population and thus the mix of goods and services produced and of the labor required to produce them. These factors continue to evolve, in some ways that perpetuate recent trends, and in other ways that suggest changes from the recent past.

Slower Labor Force Growth Ahead

The labor force has been growing more slowly over the past 20 years than it had previously been. During the 1990s, the workforce grew at an annual rate of just 1.1 percent, in contrast to the 1970s when it grew at an annual rate of 2.6 percent. This is partly because, in the years following the end of the baby boom in 1964, the fertility rate (the number of live births per capita) fell by about a quarter, and

these smaller cohorts reached working age during the 1980s. It is also partly because of a trend toward earlier retirement by male workers. That the labor force has been growing at all has been the result of progressively higher labor force participation by women (see Figure S.1) and a continuing large inflow of immigrants. Immigration tends to increase the workforce disproportionately to their numbers, because immigrants include many young adults of working age.

Most notably, workforce growth will slow even more dramatically over the next several decades. Between 2000 and 2010, the annual growth rate is projected to equal the rate in the 1990s of 1.1 percent. In the decade that follows, the rate of growth is projected to slow to just 0.4 percent, followed by an even lower 0.3 percent annual growth rate between 2020 and 2030. The slowdown of the workforce growth rate may make it more difficult for firms to recruit workers in the future, especially in periods of more rapid economic growth.



SOURCE: BLS (2003a), series LNU01300001 and LNU01300002.
NOTE: Population is those age 16 and above.

Figure S.1—Labor Force Participation Rate, by Sex, 1950–2002

Shifting Workforce Composition

The composition of the workforce will also continue to shift, largely reflecting demographic changes that have been under way for some time. Because the U.S. population as a whole has been growing older as the baby boom generation ages, the workforce has also been aging or, looking at it another way, has come into greater balance across age groups. Older people bring strengths to the workforce different from those younger people bring. However, to the extent that they are not part of the labor force and are supported by such largely pay-as-you-go programs as Social Security and Medicare, an older population imposes greater support costs per working person. These greater costs, which impinge on the quality of life for the labor force, are still less than those faced by most other developed countries. By 2050, there will be three working-age adults per elderly person in the United States compared to two in the United Kingdom, France, and Germany, and 1.4 in Japan, Spain, and Italy.

The inflow of immigrants has been largely responsible for a continuing increase in the racial and ethnic diversity of the workforce. Hispanics and Asians are the fastest-growing racial and ethnic groups in the population and workforce. In the case of Hispanics, a high birth rate is partly responsible for that, but immigration is the main driver. In addition, the steadily increasing female labor force participation rates, combined with decreasing male rates, have brought the labor force close to gender balance. The rise in female rates holds for married women and single women alike. It holds as well for women with and without minor children, and, for the latter, it holds whether they are married or not and no matter how old their children are. As a result of population aging and the increased labor force participation of women, another dimension of change is that more workers have responsibilities outside of work. This may involve caring for children, elderly parents, or both.

The Growing Importance of Worker Skill

While these attributes provide one way of characterizing the future workforce, an even more important dimension as we look to the future is the skill that potential workers bring to the workplace. The rapid pace of technological change is expected to continue to propel

demand for highly skilled workers who can develop the new technologies and bring them to market and who can exploit the new technologies in the production of goods and services. Moreover, the transition to a knowledge-based economy continues to fuel demand for well-educated workers. Maintaining a high-skilled workforce is also a key component of U.S. comparative advantage in the world economy. Shifts in organizational forms and the nature of employment relationships, brought about by new technologies and global competition, also favor such high-level cognitive skills as abstract reasoning, problem-solving, communication, and collaboration, attributes associated with so-called "knowledge work."

On the whole, educational attainment (i.e., years of schooling completed) in the United States has been rising and will probably continue to do so. Achievement scores of U.S. students, however, have been only about average when compared to those in other developed nations, despite greater public and private expenditures on education in the United States. Likewise, adults in the U.S. rank near the middle of other developed countries on tests of skill measures important for workplace literacy. Notably, the United States also tends to have a wider spread in the distribution of such skills, with more very low-skilled and very high-skilled individuals based on these assessments. Education reforms, such as those that address the funding and institutional organization of schools, and the degree of competition among schools promise to raise the productivity of education. In addition, technological developments, such as technology-mediated instruction, have the potential to improve educational outcomes and support lifelong learning through on-the-job training or training through other public and private institutions.

Options for Raising Workforce Growth in the Future

The slowdown in the growth of the workforce may have far-reaching consequences for the U.S. economy. In general, further growth of economic activity depends on a growing labor force or increases in worker productivity. Thus, the growth rate of the future labor force limits the growth rate of the economy for any given rate of productivity growth. Slower economic growth is a concern, given the rising costs of such entitlement programs for the elderly as Medicare and Social Security, which will be largely paid for by taxes on a workforce

that is growing more slowly. To the extent that it is desirable to raise the rate of labor force growth, in the short to medium term the two primary options are to increase the labor force participation rate for the current population or to increase the overall size of the population through immigration.

Given the right environment, more older workers may be motivated to retire later and continue to contribute to the nation's prosperity. Indeed, the rates of labor force participation for men age 55 and older, previously on the decline, have begin to level off and even increase at older ages. A variety of factors, including changes in incentives associated with pension plans and reforms to Social Security, mean that the reversal in the trend toward earlier retirement will likely continue. The rise in female labor force participation rates holds for women with and without minor children, regardless of marital status and the age of their children. Clearly, women with responsibilities at home are willing to work outside the home. Data from the United States and from other countries suggest that labor force participation by women with children could rise further if work could be more easily balanced with family responsibilities, such as through less-expensive child care, greater availability of public preschool programs, or more-flexible scheduling. While the overall effect on female labor force participation may be modest, the effect would likely be larger for women with lower earnings prospects. It may also be possible to raise labor force participation by groups underrepresented in the workforce. For example, fewer than one in three working-age individuals with disabilities are currently in the workforce, leaving around 12 million persons with disabilities out of the workforce. Finally, immigration offers opportunities for workforce growth. In particular, immigration policy may be applied to target highly skilled aliens, thus raising the overall skill levels of the U.S. workforce.

Demographics Will Shift the Demand for Goods and Services

So far, we have emphasized the effect of demographic trends on the characteristics of labor supply. However, those trends will also alter the mix of goods and services demanded and thus the characteristics of labor demanded by firms. Older households tend to spend their money differently from younger ones: an aging population is likely to

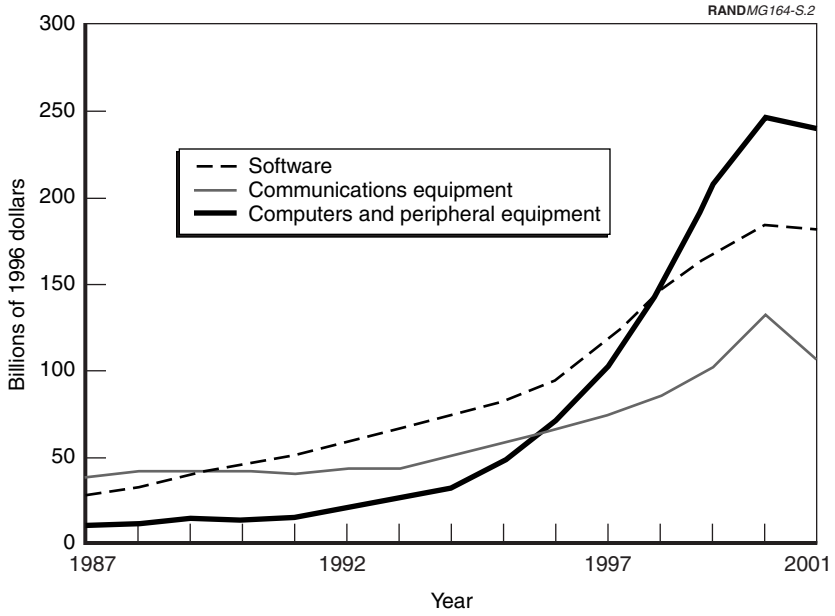
employ more health care workers and increase the demand for other health care–related products and services. Furthermore, such household activities as child care, cooking, cleaning, and gardening that used to be performed by household members may be "outsourced" to the paid workforce as women (in particular) take paid work in greater numbers.

THE EXPANDING REACH OF TECHNOLOGY

By the end of the twentieth century, the U.S. economy was shifting from one based on production to one based on information. New technologies had spawned new products and industries and had transformed the way firms in established industries were organized and labor was employed. In the coming decades, technological advances promise to further shape what is produced; how capital, material, and labor inputs are combined to produce it; how work is organized and where it is conducted; and even who is available to work.

Rapid Advance in Information Technologies

To anticipate the future consequences of technology for the workforce and workplace, consider the remarkable pace of change in the incorporation of information technologies into the U.S. economy. Computing power and storage capacity, data transmission speed, and network connectivity have increased dramatically while costs have fallen rapidly. For example, between 1970 and 1999, as the capacity of a fingernail-size silicon chip grew from a few thousand transistors to 44 million, the cost of 1 megahertz of processing power fell 45,000-fold from $7,600 to 17 cents. At the same time, greater user-friendliness of new software has led to rapid adoption of computer systems: levels of business investment in computer hardware during the mid- to late 1990s were several times those of previous years (see Figure S.2).



SOURCE: BEA NIPA Tables, Table 5.9 (http://www.bea.gov/bea/dn/nipaweb/SelectTable.asp).

Figure S.2—Real Private Fixed Investment in Information Technology, 1987–2001

While the technological advances experienced in the last several decades in IT have been remarkable, the pace of change will almost certainly continue for the next decade or more. The practical implications of further technical advances will include greater processing speed, higher storage capacity, and a wider array of applications. For example, advances in microprocessors will support real-time speech recognition and translation, and the fields of artificial intelligence and robotics are likely to advance further. The use of more intelligent robotics in manufacturing will support agile manufacturing—the ability to quickly reconfigure machines for the production of prototypes and new production runs—with implications for manufacturing logistics and inventories.

Other Evolutionary and Revolutionary Technologies Are on the Horizon

Technological progress, however, is not limited to communications and information technologies. A wide array of such technological advances as biotechnology and nanotechnology are expected to have equally profound consequences for the U.S. economy in the next several decades. In the health care sector, for example, recent progress against a variety of diseases will be married to molecular-genetic advances spawned by the Human Genome Project to yield "personalized medicine" in which drugs might be individually tailored to increase their effectiveness and reduce side effects. In the near future, progress in biotechnology is expected to generate medical advances that will further extend life expectancy and improve the quality of life for those with a chronic illness or disability, often in ways that will enhance their productive capacity in the workplace.

Nanotechnology—the manipulation of matter at the atomic scale—could afford even more-drastic revolutions in products, services, and quality of life over the next half-century. In addition to applications in electronics and IT, nanotechnology is expected to lead to breakthroughs in pharmaceuticals and other aspects of biotechnology, energy technology, and aerospace and materials technology, among others. As a cross-cutting technology, nanotechnology will facilitate technological change that extends and enhances existing technologies—further computing power for semiconductors, for example—as well as more revolutionary applications—computers no bigger than a bacterium and new materials displaying paradoxical properties of strength and flexibility and performance in heat and cold. The earliest applications in the next 10 to 15 years are likely to be in the first category, while those in the second category may be further in the future.

Many of the advances in biotechnology and nanotechnology raise social, legal, and ethical implications, among other concerns, that need to be addressed as the technologies evolve. If public acceptance of the new technologies is slow to materialize, their adoption and diffusion may not match the pace of discovery.

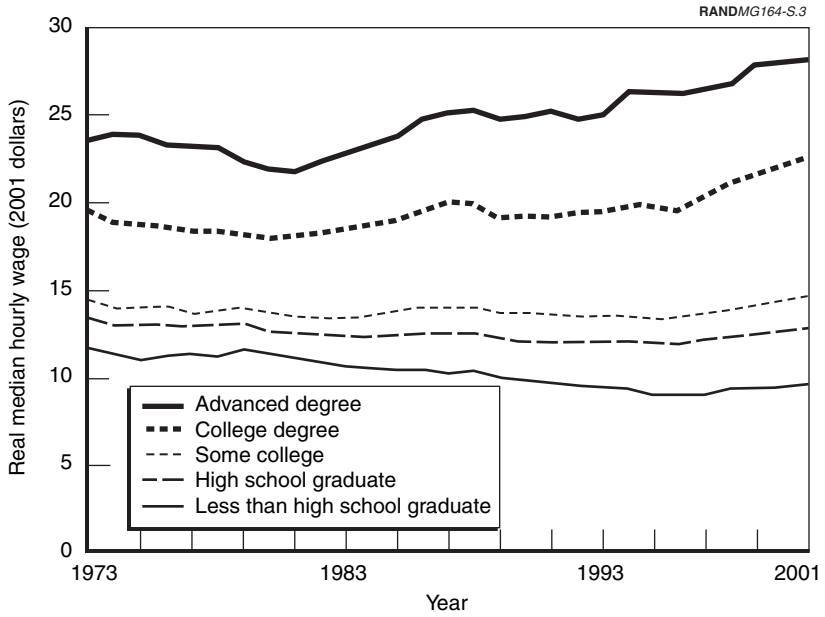
New Technologies Demand a Highly Skilled Workforce

Job skill requirements have been shifting across all sectors as a result of new technologies. Machines with microprocessors can now be programmed to do the sort of routine activities that less-skilled workers used to do. At the same time, business computer systems generate demand for highly skilled labor in the form of technical staff who operate and repair the equipment, develop and install the software, and build and monitor the networks. In addition, computer systems often generate more data that may be profitably analyzed, thereby increasing the demand for the analytical, problem-solving, and communication skills of workers, managers, and other professionals. Increasingly, the term "knowledge workers" is applied to workers who go beyond just providing information to now being responsible for generating and conveying knowledge needed for decisionmaking.

While the recent technological advances may favor either skilled or unskilled workers, depending on the application, the overwhelming evidence is that on balance, recent technological advances favor more-skilled workers and the same can be expected for future advances. Not surprisingly, those demand differentials have been driving up the salary premium paid to workers with higher education levels (see Figure S.3). For example, between 1973 and 2001, the wage premium for a college degree compared with a high school diploma increased 30 percentage points, from 46 percent to 76 percent. Researchers consistently find that technological progress that increased the demand for more-skilled workers explains a sizable portion of the rise in the wage differential by education level since the 1980s, although other factors played a role as well.

The Organization of Firms and the Workplace Respond to Technological Change

The new information technologies adopted in recent decades have had implications for other aspects of the production process, from the capital equipment used in the goods-producing sectors to the ways firms across all sectors are organized and conduct their business. Such changes have taken place in "old economy" goods-



SOURCE: Mishel, Bernstein, and Boushey (2003), Table 2.17.

Figure S.3—Real Median Hourly Wage by Education Level, 1973–2001

producing sectors, such as the steel and machine tool industries, as well as services-producing sectors, such as retailing, trucking, and banking.

The vertically integrated corporation was the dominant organizational model for much of the twentieth century. This model provided the means to control and coordinate the various stages of production, especially in an era when markets were underdeveloped and supply networks were more uncertain. While this model has by no means disappeared and revenues and production volumes may be as large as before, some sectors of the economy are moving toward more specialized, vertically disintegrated firms. With vertical disintegration, firms divide up the production pipeline and specialize broadly in products and services that define core competencies while outsourcing noncore activities. Such activities might include steps on the production chain, such as industrial design or the manufacturing of intermediate goods, or support activities, such as computing ser-

vices or human resources. This trend is facilitated by the power of information technologies and their associated networks to coordinate and control across organizations and within organizations in a more decentralized manner.

Technology also shapes firms' decisions about how to organize production within the firm and how to structure the compensation system to motivate workers at various levels of the organization. With increased investment in IT, companies have been moving toward more participatory, "high-performance" work systems. Such practices invest greater authority and problem-solving responsibilities in front-line employees rather than managers. Jobs become more flexible and broadly defined, employees work in collaborative teams requiring a high degree of information-sharing and communication, and outcomes focus on timeliness, quality, and customer service. A related development is the increased reliance on performance-based pay to improve employee motivation. Production-based pay, profit-sharing, and stock-option plans allow employees to share directly in the profitability of their employers.

Technology also facilitates telecommuting and other forms of distance work. As of 2001, nearly 20 million workers, or 15 percent of the workforce, usually did some work at home (at least one day a week) as part of their primary job. Using a broader definition of off-site work, about four out of five workers either work off-site themselves or work with others who work at a distance.

Technology Supports the Process of Lifelong Learning

As technology operates to increase the demand for more skilled labor, workers often need to undergo retraining in order to take advantage of how new technologies are utilized in the workplace or to operate within new organizational structures. At the same time, technology has great potential to support the education and training of the workforce prior to labor market entry and as a part of lifelong learning. Technology-mediated learning—the use of computers and other information technologies as an integral part of the learning process—is gaining ground through such applications as computer-based instruction, Internet-based instruction, and other methods for customized learning. Information technologies potentially allow access to instructional materials any time, any place.

New technologies in the next 10 to 20 years offer tremendous potential to revolutionize the way education and training is delivered in order to improve efficiency and effectiveness in learning. For example, one application that goes beyond traditional distance learning is the use of electronic performance support systems, typically wearable computer devices that provide real-time access to information needed on the job to perform increasingly complex, dynamic tasks. Just as individualized medicine is envisioned as an outgrowth of biotechnology, individualized learning programs that are optimized for a given person's knowledge base and learning style are expected for the future. Such learning programs will become increasingly sophisticated over time with advances in hardware and software, including artificial intelligence, voice recognition and natural language comprehension. They will also benefit from improvements in intelligent tutoring systems that allow self-paced, interactive, self-improving learning.

Productivity Benefits from New Technologies

After a long period in which it seemed that the information revolution was having no impact on worker productivity, an acceleration of the annual rate of productivity increase began in 1995 and has not been slowed by the post-2000 economic downturn. The productivity gains were not limited to a few industries but applied to a range, including durable-goods manufacturing and such services as wholesale and retail trade and finance. Analyses by economists indicate that the rise in economywide productivity can be attributed to growing productivity within the IT sector itself, as well as increased productivity in other sectors of the economy. Given that these new technologies have yet to reach saturation in the economy, most analysts expect the boost to productivity from the IT revolution to continue for the near term.

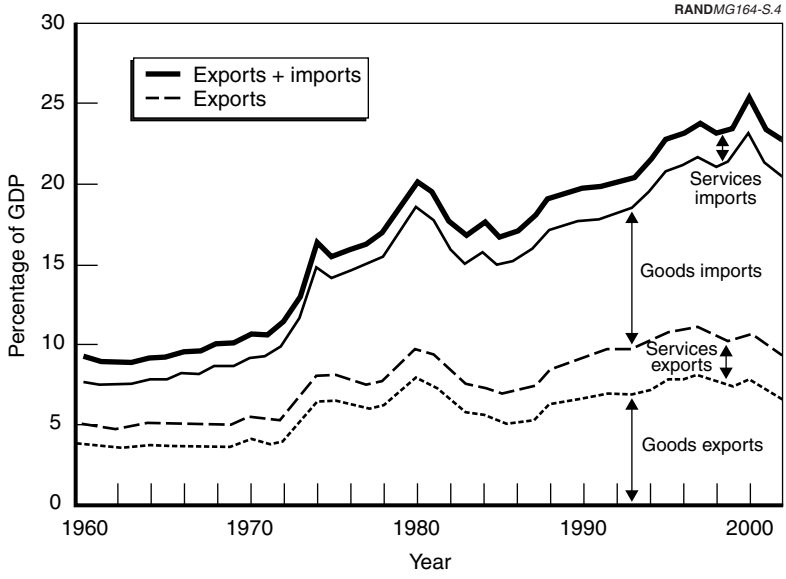
GLOBAL ECONOMIC INTEGRATION

With the growth of economic globalization in recent decades—whether measured by flows of goods and services, direct investment and other capital flows, the transfer of knowledge or technology, or the movement of people—the economies of the world are tied together even more so than in the past. In the decades ahead, the era

of economic globalization will affect the size of the markets we produce for, the mix of products we consume, and the nature of the competition in the global marketplace. It also has implications for the labor market that U.S. workers compete in and the sources of domestic and international labor available to U.S. firms.

The Dimensions of Economic Globalization

Recent decades have been marked by dramatic increases in trade. Total trade activity (exports plus imports) has increased from about one-tenth of U.S. gross domestic product (GDP) in 1960 to about a quarter at the turn of the century (see Figure S.4). Meanwhile, the sectoral distribution of trade has changed. Trade in services has grown from 18 to 30 percent of the total over the last 20 years. Another important new aspect of trade patterns, called "vertical



SOURCES: BEA U.S. International Transactions Accounts Data, Table 1 (http://www.bea.gov/bea/international/bp_web), and BEA NIPA Tables, Table 1.1 (http://www.bea.gov/bea/dn/nipaweb/SelectTable.asp).

Figure S.4—U.S. Exports and Imports as a Share of GDP, 1960–2002

trade," is that finished products may be composed of inputs produced and assembled in stages in different countries. Multinational firms no longer limit production to a single country but carve up the production process into stages implemented in multiple countries through subsidiaries or contractors. This allows more labor-intensive stages of the production process to be located in lower-wage settings, as opposed to stages that are more capital-, knowledge-, or technology-intensive, which are located in higher-wage settings. This pattern of specialization extends on a global scale the vertical disintegration of the firm discussed above in the context of technological change.

Not only manufacturing jobs have been outsourced overseas but also higher-skilled white-collar jobs in the services sector, such as IT and business-processing services. Advances in communication technologies and falling prices associated with voice and data transmission facilitate the shift of IT-enabled services from the United States to overseas locations in such countries as China, Costa Rica, Hungary, India, Ireland, and the Philippines. Since the work products in many information-based and knowledge-based industries can be readily transmitted over high-speed computer networks, the physical location of the workforce is increasingly less relevant. Data to estimate the extent of international outsourcing in the services sector are not readily available, but some estimates suggest that the movement is relatively modest to date but growing. In the future, companies may choose to blend onshore and offshore models to offer greater flexibility as well as the capacity to work around the clock.

As trade flows have increased and production has become more internationalized, the United States has altered the mix of trading partners toward countries with lower wages. While Canada remains the largest trading partner with the United States in terms of goods exported and imported, Mexico assumed the second-place ranking as of 1999, displacing Japan from that position. Trade with China has also grown dramatically, from less than 1 percent of U.S. goods imports in 1980 to 11 percent in 2002, exceeding goods imports from Japan for the first time. Even so, more than half of U.S. goods trade takes place with other industrialized countries where wages are more comparable.

Globalization has extended to capital flows and labor skills. U.S. acquisition of foreign assets increased sixfold between 1980 and 2000, and foreign acquisition of U.S. assets grew even more. Capital flows increasingly take the form of direct investment in companies overseas as a means to control production and expand into new markets. Worldwide migration has doubled in the last quarter-century, resulting in greater circulation of workers, not only the less-skilled but also the highly skilled. At the same time, IT advances have enabled highly skilled workers on different continents to collaborate without physically relocating. The internationalization of labor is also tied to the greater ease with which new knowledge and technologies are transferred across international boundaries.

Forces Propelling Globalization Will Continue

What is driving the current wave of economic globalization? First, over the past 50 years, communication and information transmission costs have declined precipitously, along with transportation costs. For instance, a call from New York to London that would have cost $1 in 1950 cost just 6 cents as of 1990, and the call is essentially free today using the Internet (although the quality might not be as good). Through voice, video, and electronic communications, firms can work with subsidiaries or suppliers in other countries and ensure the quality and timeliness of product delivery necessary to meet their own production processes. The revolution in information technologies also provides a mechanism for rapid transmission across electronic networks of inputs and outputs in the IT-enabled services sector, as well as the means for supervising work products and monitoring quality. Second, since the end of World War II, a series of trade agreements have reduced barriers to trade, while the move to flexible exchange rates in the early 1970s, combined with other financial reforms and new financial instruments, increased capital mobility.

On balance, we believe the trend toward a globally integrated economy is likely to continue, driven by further IT advances and reductions in trade and capital market barriers. However, there may be efforts to link further trade and capital market liberalization with particular countries or regions to concerns over labor standards, the environment, human rights, the existence of democratic institutions, or the protection of property rights. There are also signs that other

countries, especially low-income nations, are more reluctant to seek further liberalization without the major industrialized countries relaxing some of their remaining barriers (e.g., subsidies for agricultural products, patent protections on pharmaceuticals). If so, this may limit the pace of expansion of trade between the United States and developing countries.

Economic Globalization Generates Aggregate Benefits to the Economy

The consensus among economists is that globalization has had and can be expected to continue to have, at the aggregate level, a favorable effect on income, prices, consumer choice, competition, and innovation in the United States. In terms of long-run growth, at the same time that trade's share of the U.S. economy more than doubled in the last four decades of the twentieth century, real GDP per capita—a measure of U.S. standard of living—did so also.

From the perspective of U.S. consumers, trade typically expands the range of choices available and results in the reduction of prices for some goods when foreign suppliers can produce them at less cost. For U.S. firms, a more open world economy expands the size of the market they can sell to, elevating sales and possibly reducing costs and raising productivity through economies of scale. At the same time, the increased openness of U.S. markets, both through export competition and import competition, pressures U.S. firms to remain competitive in the global marketplace. Such forces spur innovation and adoption of technologies and production processes that can reduce cost. Trade also provides access to foreign technology and ideas (e.g., business organization practices), which further allow productivity gains for U.S. firms.

Globalization Also Has Distributional Consequences

While greater integration in world trade and capital markets can enhance welfare at the national level and over the long term, there can be short-term and longer-term consequences for particular segments of the U.S. economy and workforce as labor, capital, and other inputs are reallocated to their most efficient uses. Some industries

facing greater import competition will lose jobs. At the same time, trade generates new jobs for U.S. workers in domestic exporting industries. As of 1999, for example, an estimated 11.6 million jobs in the United States were supported directly or indirectly by goods and services exports, representing about 9 percent of employment. With continued growth in exports relative to GDP, that share is likely to expand. In two industries—computers and electronic products and primary metals—more than one-third of jobs were tied to exports as of 1997. On balance, research suggests that the effect of trade on overall employment levels is, at most, small, with job losses caused by import competition counterbalanced by job gains that stem from expanding exports.

Economywide, most workers displaced due to a plant move or closing, elimination of a position or other factors that lead to involuntary job loss find new jobs although they may experience spells of unemployment and face permanent wage losses. For example, the typical, or median, worker displaced in the late 1990s experienced a little more than five weeks of unemployment before finding a new job. Earlier in the 1990s, when the labor market was weaker, the typical unemployment spell was about three weeks longer. Studies of the longer-term consequences of job displacement suggest permanent earnings losses in the range of 5 to 15 percent. More-educated workers tend to be reemployed more rapidly than their less-educated counterparts and their relative earnings losses tend to be smaller, presumably because their skills transfer more easily from one job to the next. This suggests that, while painful, future job loss associated with higher-skilled services-sector employment might not be as costly in terms of unemployment and permanent wage loss as were earlier waves of blue-collar trade-related job displacement.

Globalization has also been linked to the relative decline in earnings among less-skilled workers over the last few decades. Research suggests that, while trade made a modest contribution to the trend, other factors, such as technology and immigration, were more important. It must also be kept in mind that many less-skilled workers are employed in nontradable services and thus will not be directly affected by globalization. In the future, if trade in services that involve more highly skilled jobs continues to grow, trade will affect a

larger share of the workforce, so the effect on the wage structure could become larger over time.

THE IMPLICATIONS FOR THE FUTURE OF WORK

The three forces we have examined do not move independently of one another but can be expected to have important interactive effects. Given these interactions, we seek to anticipate the implications of these interrelated and interacting forces for the future of work. These issues are relevant from the perspective of current and future workers who wish to anticipate future trends and how they might respond in terms of investments in their human capital and other decisions throughout their working lives. Other issues pertain to choices that employers make about how to organize their workplaces, invest in their employees, and structure employee compensation. Policymakers at the federal, state, and local levels also make decisions that shape the laws and regulations governing the workplace and other policies that may provide incentives or disincentives for behavior on the part of workers or employers. Other interested parties include public- and private-sector education and training institutions that help shape the quality of the future workforce.

The Organization of Production

Technological advances and globalization are changing the way production is structured, pushing firms toward vertical disintegration and specialization, decentralized decisionmaking, and attaching a premium to acquiring and sustaining knowledge as a means of achieving competitive advantage. Such specialization allows firms, which may remain as large as ever, to exploit their comparative advantage in the provision of particular goods and services, while outsourcing those functions peripheral to the core business. With more decentralized decisionmaking, striking the right balance between empowerment and control will be an important management element in the future workplace.

In some sectors, these trends could result in the disintegration of firms to the individual level in the form of numerous IT-enabled, networked, self-employed individuals or "e-lancers." In this new business model, individuals may compete in a global market for

project opportunities and may work on multiple projects at any given time. Project teams continually dissolve as old projects are completed and form as new projects begin. Issues associated with a more decentralized e-lance model of production include access to the full range of tangible and intangible benefits that come with traditional employment relationships: economic security through employment continuity and subsidized employee welfare benefits, professional development through training and other opportunities, social connections to workplace colleagues, and a sense of professional identity. In the future, some or all of these functions may be provided by worker associations, organizations independent of particular employment relationships. Existing organizations (e.g., professional or community groups) may take on these functions or new organizations may be established defined by occupational groups or geographic areas to take on this role.

The evolution of organizational forms in the next 10 to 15 years is not expected to rapidly converge on any one particular model. Instead, organizations are expected to adapt in the future in response to the nature of innovation, markets, networks, and information costs. Thus, we can expect large corporations to continue to exist, albeit with greater specialization of function than in the past, at the same time that the prevalence of decentralized networks of small organizations grows. Within these new paradigms of specialized firms, decentralized decisionmaking, and knowledge-based organizations, employers in the coming decades will require a workforce with well-developed analytical skills and communication and collaboration skills.

The Nature of Employer-Employee Relationships and Work Location

The conventional model of employment is that of full-time jobs of indefinite duration at a facility owned or rented by the employer. The forces driving the reorganization of production are expected to decrease the fraction of workers in such traditional arrangements and increase the fraction in such nonstandard arrangements as self-employment, contract work, and temporary help. Already, about one in every four U.S. workers is in some nontraditional employment relationship. These alternative work arrangements may become

more prevalent in the face of rapid technological change and competitive market pressures. A further increase could result from increases in labor force participation among subgroups of the population, such as the disabled or older workers who have a preference for more flexible work arrangements. To the extent that the ranks of workers in nonstandard work arrangements grow in the future, one issue will be access to traditional workplace benefits. It may be worthwhile to implement policies promoting health and pension coverage among workers in nonstandard arrangements, whether through the tax code or access through business or professional associations. The latter may be modeled on the worker associations as discussed above.

As advances in IT continue to weaken the bonds between work and workplace, a greater proportion of the labor force will be working at home or in other locations removed from their employer's headquarters (or client's office). Part-time or full-time telecommuting can allow employers to accommodate the needs of workers who care for children at home or a sick family member. Older workers and the disabled may also benefit from nontraditional workplace arrangements. This geographical separation, where it crosses state boundaries, will increasingly raise questions about which jurisdiction's work-related policies apply.

Changes in business organization, management structures, and employment relationships have other implications for the relationship between employers and their employees in more-traditional employment relationships. On the one hand, shifts in organizational form and the use of nonstandard work arrangements weaken the bonds between employers and their employees. On the other hand, many employers increasingly recognize the human capital and knowledge base of their employees as a critical asset. Within this context, the use of high-performance workplace practices that give greater decisionmaking authority to front-line employees is blurring the traditional distinction between "labor" and "management." Changing employer-employee relationships will also alter the opportunities and challenges faced by labor unions.

Workplace Safety, Security, and Privacy

While workplace safety and security concerns focused in the past on high-risk industries in the goods-producing sector, these issues now resonate with virtually all employers and the entire workforce. In the coming decades, the aging of the workforce may raise new safety concerns in traditional or emerging industries. For example, workers age 65 and older have been shown to experience higher rates of permanent disabilities and workplace fatalities compared with their younger counterparts in the same industries and occupations. Emerging technologies may present new health and safety concerns (e.g., those associated with nanotechnology or biotechnology). At the same time, technological advances may provide new solutions for improving worker safety. Workplace security, in the face of terrorist or other security threats to workers in the United States or overseas, raises issues regarding the balance between public-sector investments in workplace security and private-sector security investments. Privacy concerns will become more prominent as a result of various technological advances that facilitate employee monitoring and access to sensitive information.

The Nature of Work and Job Skill Requirements

Future technological developments will increase the demand for highly skilled workers who can develop and market the new technologies, while other workers will be involved in production processes or in the production of goods and services based on these technological advances. A growing emphasis on knowledge workers and knowledge-based organizations can further define a source of competitive advantage for U.S. workers and employers. The shift in organizational forms and the nature of employment relationships also favor strong cognitive and entrepreneurial skills. Workers who increasingly interact in a global marketplace and participate in global work teams will require the skills needed to collaborate and interact in diverse cultural and linguistic settings. At the same time, demographic and other factors will drive demand for traditionally lower-skilled jobs in retail trade, health services, and other personal services. None of these jobs typically require postsecondary education, although training often is an important component of job preparation. In addition, more of these jobs in the future are likely to incor-

porate new technologies but typically with intuitive interfaces accessible to individuals who are not technologically sophisticated.

A variety of forces appear to be shifting the workforce away from more permanent or lifetime jobs toward less permanent, even nonstandard employment relationships. Thus, the labor market will require a workforce adaptable throughout the life course to changing technology and product demand. As less-competitive sectors of the economy lose jobs, workers who can retrain will be better able to adjust and find productive reemployment. The prospects of continued or even accelerating job displacement as a result of technological change and trade also invite consideration of current and future policies to help workers adjust to these shocks.

In this context, consideration must be given to how the U.S. education and training system can evolve to better meet the needs of the twenty-first-century workforce. Workforce education and training in the future will involve continuous learning throughout the working life, involving training and retraining that continues well past initial entry into the labor market. Challenges for the private and public sectors include improving educational outcomes at the primary and secondary levels of education, developing opportunities for career-long learning through formal and informal training opportunities, and meeting the growing need for scientists and engineers who can advance new technologies in the laboratory, develop the applications, and bring them to market.

Technology-mediated learning, which offers the advantage of individualized learning programs that can be accessed "any time any place," may help meet training challenges and support life-long learning. In addition, as e-learning materials become more common in routine work processes (e.g., the use of wearable devices with procedural information to supplement prior training and reduce errors), continuous training and lifelong learning can become a reality.

The Size and Composition of the Workforce

Current demographic forecasts estimate no change in the growth rate of the labor force over the coming decade and even a likely slowdown after that. Such projections depend critically on assumptions regarding underlying population growth rates (immigration

being one important factor) and rates of labor force participation among demographic subgroups. Labor force growth rates can exceed current projections to the extent that labor force participation can rise for groups not fully employed.

Thus, an important issue is whether tapping underutilized labor force capacity can contribute substantially to a larger workforce. Some older workers are lengthening their careers, and more might do so if employers show more flexibility in job responsibilities, hours worked, and pay (and if government permits such flexibility). There is room for progress in this regard: 63 percent of workers age 59 or over say that their employer would not let them move to a less demanding job with less pay if they wanted to. Greater attention to work-family balance issues may increase the labor force participation of women, particularly women with children. Technological advances may aid the labor force participation of people with disabilities by alleviating the disabilities themselves or their impact on ability to work. Other demographic groups that may be targets for greater inclusion are low-income women with children, former military personnel, and immigrants.

From the perspective of employers, strategies to make work more attractive than remaining out of the labor force are not cost-free. In tight labor markets, employers may offer higher wages. They may also offer more attractive work conditions (such as flexible scheduling or telecommuting) or more generous fringe benefits (such as time off for family emergencies, on-site child care, or assistance with elder care). In their negotiations about compensation, prospective workers and firms may trade off among cash wages, working conditions, and benefits. The key challenge will be to identify the compensation mix that attracts the most new workers for any given total cost increase. Government policies may constrain employers' abilities to increase participation among some groups. For example, government policies currently limit employers' ability to adjust benefits for older workers to account for changes in preferences for health insurance, pension benefits, and other employee benefits as workers age.

Compensation in the Form of Wages and Benefits

Future trends in technology, globalization, and demographics are also likely to affect the level and distribution of wages, just as they

have in the past several decades. Continued technological progress has the potential to lead to further productivity gains that would support growth in real wages (or total compensation to the extent that compensation patterns shift from wages to benefits). At the same time, mechanisms driving greater wage disparities in the recent past, namely technological change and globalization among others, can be expected to exert the same pressures in the near term. In the absence of a strong increase in the supply of skilled workers in response to the higher returns to education, wage dispersion—particularly as measured by the gap between more- and less-educated workers—will likely remain at current levels or continue to widen.

Meanwhile, a variety of factors may weaken the tie between employment and access to fringe benefits. Greater turnover within traditional employment relationships and shifts to nonstandard employment relationships also spotlight the importance of fringe benefits that are portable across jobs or even independent of jobs (in the case of freelancers, for example). Employers that do offer benefits may move toward more personalized structures, tailored to meet the circumstances of each employee. Younger and older workers, for example, might be allowed to select those benefits that fit their circumstances with corresponding adjustments in cash wages to retain current compensation levels. Information technologies and outsourcing may support this trend by reducing the costs associated with managing a more complex system of employee benefits.

We have identified a number of ways in which the workforce and workplace are likely to differ in the early decades of the twenty-first century compared with the experience of the twentieth century. At the same time, many of the institutional features of the U.S. labor market—such as the laws and regulations that govern employment, hours, wages, fringe benefits, occupational health and safety, and so on—evolved in the context of an earlier era. In some cases, these policies need to be reexamined in light of the evolution of the labor market in the coming decades. Are there distortions or unintended consequences associated with current policies that preclude desirable market adjustments? Are policies put in place to address market failures in the past less relevant, given parameters that exist today and their likely future evolution? Are there new market failures that policy can address? Are there distributional consequences that could make a case for government intervention? These questions merit a

more detailed examiniation in the context of the future of the workforce, workplace, and compensation in the twenty-first century.